

Project 1: *Development of Scab Resistant Cultivars for Kansas*

1. What are the major goals and objectives of the research project?

The long-term goal of this research is to develop hard red and hard white winter wheat cultivars adapted for Kansas with improved resistance to scab. Short term objectives are to: 1) test existing local cultivars for reaction to scab, 2) test advanced breeding lines for reaction to scab, 3) test exotic germplasm lines for reaction to scab, 4) test the Hard Winter Wheat (Kansas, Montana, Oklahoma, Texas, Nebraska, South Dakota, North Dakota) Scab Nursery for reaction to scab, and 5) incorporate newly identified sources of scab resistance into the Kansas wheat breeding program.

2. What was accomplished under these goals or objectives? (For each major goal/objective, address these three items below.)

a) What were the major activities?

- 1) Hard Winter Wheat FHB Nursery: 15 entries each (120 total) from FHB breeding programs in Kansas, Nebraska, Oklahoma, Colorado, Texas, South Dakota, Montana, and North Dakota were evaluated. Check cultivars were added to the above entries; Everest (moderately resistant), Karl 92 (intermediate), and Overley (susceptible). The Northern Nursery uses checks Emerson (R-MR) and Flourish (susceptible.)
- 2) Private Breeder Winter Wheat FHB Nursery: 15 entries (60 total) from four major private wheat breeding programs in the region. Three check cultivars will be added to the above entries; Everest (moderately resistant), Karl 92 (intermediate), and Overley (susceptible).
- 3) Kansas Commercial Cultivar FHB Nursery: 15-25 common Kansas commercial cultivars.
- 4) Kansas Intrastate FHB Nursery: 30 advanced breeding lines from wheat breeders at Kansas State University.
- 5) Wheat Breeding FHB Nurseries: Additional breeding material, mostly involving populations for recurrent selection, from Dr. Allan Fritz' wheat breeding programs.
- 6) Response to Fungicide: Advanced Yield Nursery x Fungicide was added due to a request from the EC. These lines were evaluated for their response to control of FHB by foliar fungicides. This experiment will utilize 5' by 15' plots for yield determinations.
- 7) These nurseries were planted each fall. They were inoculated using corn spawn inoculum, heading date was recorded and all entries were evaluated throughout season. Plots were harvested for FDK and DON analysis.

b) What were the significant results?

Until involvement in the USDA Scab Initiative, there was little effort to identify sources of scab resistance in Kansas breeding programs. The Initiative has resulted in the development of accurate and efficient field testing nurseries that are providing useful ratings for current cultivars in Kansas and advanced breeding lines. This screening effort now includes entries from winter wheat breeding programs throughout the Great Plains region. The long-term goal of the research is to develop, deploy, and advertise winter wheat cultivars adapted for Kansas with improved levels of resistance to scab.

c) List key outcomes or other achievements.

In 2009, Kansas State University released the first hard red winter wheat cultivar adapted to Kansas selected for improved levels of resistance to scab. This variety "Everest" is still a top variety in KS representing more than 60% of the acres planted in regions of the state most prone to FHB. KSU released a new variety, Zenda, with moderate levels of resistance to FHB in 2016, several private breeding programs have also released varieties with improved resistance to FHB including Bob Dole, WB4269, WB4699 and SY Benefit. The screening nurseries supported by the USWBSI were essential in the development of these varieties. In 2019 KS Venada (I), KS Venada (I) and KS Western Star were released. In 2020, KS Hatchett (MS). These varieties have all been evaluated in our nursery. A key additional component is that these have been evaluated for their response to fungicide as well.

3. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns and/or restrictions, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.

COVID-19 pandemic did disrupt the flow of research. Despite these challenges, all objectives were accomplished for FY20. We were fortunate that field research was deemed essential and allowed to continue.

4. What opportunities for training and professional development has the project provided?

The FHB screening nursery provides training opportunities for 3 graduate students and 1 undergraduate within the Applied Wheat Pathology Lab to gain hands-on experience in the operation and rating of these multi-disciplinary projects. Students are involved in every aspect of the project from planting, harvest and processing the diseased grain.

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5. How have the results been disseminated to communities of interest?

Reports of the phenotyping nurseries are sent to all cooperating breeding programs. These include the public wheat breeding efforts in Kansas, Nebraska, South Dakota, and North Dakota. Similar reports are sent to the breeding efforts in participating private companies.

Information about current wheat varieties is released via KSU extension publications "*Wheat Variety Disease and Insect Ratings, 2020*" and "*Kansas Performance Tests with Winter Wheat Varieties*". Both publications are available as "hard copy" or online. Thirteen plant disease management reports were also published. These results are available through the Plant Management Network and also available on the Scab website.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY20 award period (5/15/20 - 5/14/21). The term “support” below includes any level of benefit to the student, ranging from full stipend plus tuition to the situation where the student’s stipend was paid from other funds, but who learned how to rate scab in a misted nursery paid for by the USWBSI, and anything in between.

- 1. Did any graduate students in your research program supported by funding from your USWBSI grant earn their MS degree during the FY20 award period?**

Yes No

If yes, how many? [Click to enter number here.](#)

- 2. Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY20 award period?**

Yes No

If yes, how many? [Click to enter number here.](#)

- 3. Have any post docs who worked for you during the FY20 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

Yes No

If yes, how many? [Click to enter number here.](#)

- 4. Have any post docs who worked for you during the FY20 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

Yes No

If yes, how many? [Click to enter number here.](#)

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Release of Germplasm/Cultivars

Instructions: In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the FY20 award period (5/15/20 - 5/14/21). All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations.

NOTE: Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.

| Name of Germplasm/Cultivar | Grain Class | FHB Resistance | FHB Rating (0-9) | Year Released |
|----------------------------|-----------------------|--|--------------------------|---------------|
| KS Hatchett | HRW - Hard Red Winter | MS - Moderately Susceptible | 5 | 2020 |
| Click here to enter text. | Select Grain Class | Select what represents your most resistant check | Enter as text 0-9 rating | Select Year |
| Click here to enter text. | Select Grain Class | Select what represents your most resistant check | Enter as text 0-9 rating | Select Year |
| Click here to enter text. | Select Grain Class | Select what represents your most resistant check | Enter as text 0-9 rating | Select Year |
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NOTE: List the associated release notice or publication under the appropriate sub-section in the 'Publications' section of the FPR.

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Publications, Conference Papers, and Presentations

Instructions: Refer to the PR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY20 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (5/15/20 - 5/14/21)** should be included. If you did not publish/submit or present anything, state 'Nothing to Report' directly above the Journal publications section.

NOTE: Directly below each citation, you **must** indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in the publication/presentation. See example below for a poster presentation with an abstract:

Winn, Z.J., Acharya, R., Lyerly, J., Brown-Guedira, G., Cowger, C., Griffey, C., Fitzgerald, J., Mason R.E., and Murphy, J.P. (2020, Dec 7-11). Mapping of Fusarium Head Blight Resistance in NC13-20076 Soft Red Winter Wheat (p. 12). In: Canty, S., Hoffstetter, A. and Dill-Macky, R. (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum*. https://scabusa.org/pdfs/NFHF20_Proceedings.pdf.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

Nothing to report.

Books or other non-periodical, one-time publications.

Nothing to report.

Other publications, conference papers and presentations.

Extension Publications:

Lingenfelter, J., Auld, A., Davis, H., De Wolf, E., Fritz, A., Knapp, M., Lollato, R., Whitworth, J., Winne, S., Adee, E., Esser, A., Kimball, J., Larson, M., Haag, L., Mengarelli, L., Sassenrath, G., Schlegel, A., Seaman, C., Zhang, G., Knopf, J. and Bohnert, C. 2020. Wheat Performance Tests with Winter Wheat Varieties: Report of Progress. Kansas Agricultural Experiment Station; No.1151.

Status: Published

Acknowledgement of Federal Support: No, (not generally done for this type of publication)

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Andersen Onofre, K., De Wolf, E.D., Lollato, R. and Whitworth, J. R. 2020. Wheat variety disease and insect ratings, 2020. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. Pub. No. MF991.

Status: Published

Acknowledgement of Federal Support: No (not generally done for this type of publication)

Andersen Onofre, K., De Wolf, E.D. 2020. Foliar fungicide efficacy ratings for wheat disease management, 2020. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. Pub. No. EP130.

Status: Published

Acknowledgement of Federal Support: No (not generally done for this type of publication)

Technical Reports:

Ranabhat, N., Bruce, M., Davis, M., and **Rupp, J.L.**, (2020) Reaction of selected Kansas winter wheat cultivars to Barley yellow dwarf, 2019. Plant Disease Management Report (PDMR), 14:CF088.

Status: Published

Acknowledgement of Federal Support: Yes

Mangel, D., Bruce, M., Davis, M., and **Rupp, J.L.**, (2020) Evaluation of foliar fungicides for control of tan spot of spring wheat, 2019. Plant Disease Management Report (PDMR), 14:CF089.

Status: Published

Acknowledgement of Federal Support: Yes

Mangel, D., Bruce, M., Davis, M., and **Rupp, J.L.**, (2020) Reaction of Kansas Intrastate Nursery winter wheat accessions to Fusarium head blight, 2019. Plant Disease Management Report (PDMR). 14:CF090.

Status: Published

Acknowledgment of Federal Support: Yes

Ranabhat, N., Bruce, M., Davis, M., and **Rupp, J.L.**, (2020) Reaction of Kansas and Nebraska winter wheat accessions to Fusarium head blight (FHB), 2019. Plant Disease Management Report (PDMR), 14:CF091.

Status: Published

Acknowledgement of Federal Support: Yes

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Proceedings:

Mangel, D., Bruce, M., Davis, M., and **Rupp, J.L.** (2020) Impact of Environmental Conditions on fungicide ability to control Fusarium head blight under field nursery conditions (p. 77). In: Canty, S., Hoffstetter, A. and Dill-Macky, R. (Eds.), Proceedings of the 2020 National Fusarium Head Blight Forum.

https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: No